University of Central Punjab

Faculty of Information Technology

Data Structures and Algorithms
Fall 2021

Lab 05	
Topic	• Abstract Classes • Templates • ADT Queue • Application Queue
Objective	The basic purpose of the lab is to understanding of the ADT queue, its implementation and its applications

Instructions:

- Indent your code.
- Comment your code.
- Use meaningful variable names.
- Plan your code carefully on a piece of paper before you implement it.
- Name of the program should be same as the task name. i.e. the first program should be Task_1.cpp
- **void main() is not allowed. Use int main()**
- **You have to work in multiple files. i.e separate .h and .cpp files**
- **You are not allowed to use system("pause")**
- **You are not allowed to use any built-in functions**
- **You are required to follow the naming conventions as follow:**
    - **Variables:** firstName; (no underscores allowed)
    - **Function:** getName(); (no underscores allowed)
    - **ClassName:** BankAccount (no underscores allowed)

Students are required to complete the following tasks in lab timings.

Task 1

Create a C++ generic abstract class named as **ADT Queue**, with the following:

Functions:

virtual bool isEmpty() const = 0;

- Returns true if the queue is empty otherwise it returns false

virtual bool isFull() const = 0;

- Returns true if the queue is full otherwise it returns false

virtual InitializeQueue() const = 0;

- Its initializes the memory of the queue by user defined size

virtual void enQueue (Type) const = 0;

- Its places the new element at the rear of the queue

virtual void deQueue (Type) const = 0;

- It removes the element from front of the queue and front move forward

virtual void printQueue() const = 0;

- It prints all the elements of the queue

Task 2

Consider you are working in customer care branch of an organization. You are only allowed deal the **N** customers. Here, N is basically the size of the Queue that you have declared. The very first customer occupies the space at front of the queue and every new customer gets space on the rear of the queue. When the customer gets his services, it get de-queued from the queue and front moves to next customer. It keeps going until the last customer is get entertained.

Write a C++ program which creates a class myQueue using the class ADT Queue that you have created in task 1

Attributes:

```
1.    Type * list;
2.      int  front;
3.      int  rear;
4.      int  maxsize;
```

Functions:

Implement all the virtual functions declared in base class

Your program should be menu based:

- Press 1 to add new customer the queue
- Press 2 to remove item from the queue
- Press 3 to check if the queue is full.
- Press 4 to check if the queue is empty
- Press 5 to display the queue.
- Press 6 to exit

- Write parameterized constructor with default arguments for the above class.
- Write Copy constructor for the above class.
- Write Destructor for the above class.

Task 3

You are required to add two numbers of 5 digits each using Stack and Queue. You may use the Stack implementation from the last lab. You may follow the following steps to solve this problem unless you can think of a better method!

- Separate the digits of each number and insert them into two separate queues starting from their last digits.
- De-queue one number each from the two queues.
- Add them.
- Divide the sum by 10.
- Push the remainder into a Stack and the Quotient (i.e., carry) would be added to the sum of next two numbers.
- Repeat Steps 2 – 5 until both queues are empty.
- Pop all elements of the Stack one by one and push them onto a new Stack.
- Print the new Stack. It will be the sum of the two 10-digit number